

* The neutral, non polar, and non essential a.a.
from the a.a. are:
(1) Glycine, (2) Alanine (3) Proline
that means pro, gly, Ala ~~are~~ have the same
classifications:

chem: neutral, side chain: non polar, Biological: non essential, (P)

* Same classifications

(1) pro, Gly, Ala \rightarrow Neutral, non polar, non essential, glucogenic
(have same classifications) a.a.

(2) Val and meth \rightarrow Neutral, non polar, essential,
glucogenic a.a.

(3) ile, Trp, phe \rightarrow Neutral, non polar, essential,
mixed ketogenic and
glucogenic a.a.

(4) leu \rightarrow neutral, non polar, essential,
ketogenic a.a.

(5) Ser, Asn, Cys, gln \rightarrow neutral, polar - non ionized,
non essential, glucogenic

(6) (Tyr) neutral, polar - non ionized, non essential,
mixed ketogenic and glucogenic

(7) * Threonine (Thr) is the only ~~amino~~
neutral, polar - non ionized, glucogenic
amino acid that is "essential".

(8) All acidic a.a. (asp) \rightarrow aspartic / (aspartate) acid
• (glu) \rightarrow glutamic / (glutamate) acid
are: acidic, polar-ionized, non essential,
glucogenic

(9) All basic a.a (his, lys, arg) \rightarrow Histidine, Lysine,
Arginine
are \rightarrow basic, polar-ionized, essential
glucogenic except Lysine (lys)
it's Ketogenic

main points of a.a.

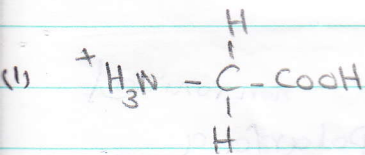
(1) classifications / names / letter codes

\rightarrow structures

(2) pKa

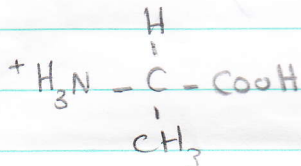
Structure/Name/
letter code

Classifications (Chemical, according to polarity of R group,
Biological, metabolic)



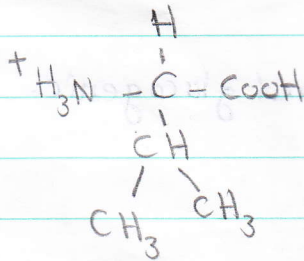
(1) Glycine (Gly)

- * Chemical: neutral a.a. (monocarboxyl- monoamine)
- * according to Polarity of R group: non polar - a.a.
non ionized
- * Biological (nutritional): ^{غذائي} non-essential a.a.
- * Metabolic: Glucogenic a.a.



(2) Alanine (Ala)

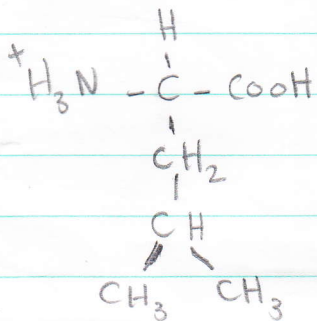
- * Chemical: Neutral a.a.
- * acco - to polarity of R-group: non Polar a.a.
non ionized
- * Biological: ~~non~~ non-essential. a.a.
- * Metabolic: Glucogenic a.a.



- * Chemical: Neutral. a.a.
- * acco - to polarity of R-gr: Non-Polar ^{non ionized} a.a.
- * Biological (nutritional): Essential. a.a.
- * Metabolic: Glucogenic. a.a.

(3) Valine (Val)

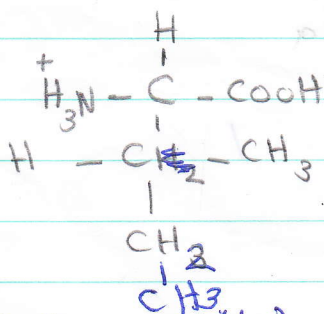
*



- * Chemical: neutral a.a.
- * acco - to polarity of R-group: non Polar a.a.
non ionized
- * Biological: essential a.a.
- * Metabolic: ~~ketogenic~~ Ketogenic. a.a.

(4) Leucine (Leu)

//



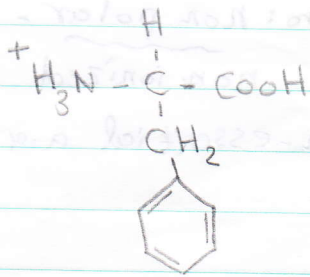
(5) Isoleucine (Ile)

- * Chemical: neutral a.a.
- * acco - to Polarity of R-group: non-Polar a.a.
non ionized
- * Biological: essential a.a.
- * Metabolic: mixed Ketogenic and glyco genic. a.a.

///

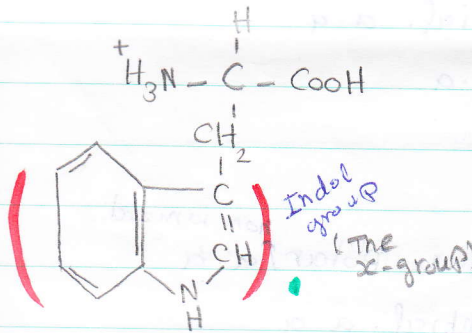
Structure/ Name/
letter code

Classification (Chemical, according to polarity of
R group, Biological, metabolic)



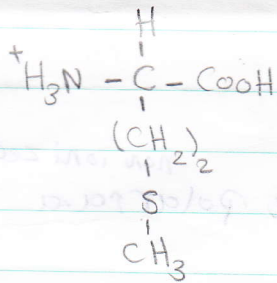
- * Chemical: neutral a.a. non ionized
- * acco- to polarity of R-gr: non-polar a.a.
- * Biological: essential a.a.
- * Metabolic: mixed ketogenic and glucogenic.

(6) Phenylalanine (Phe)



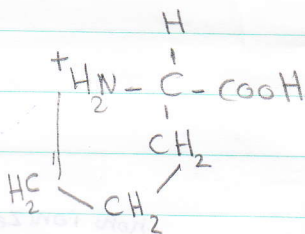
- * Chemical: neutral a.a. non ionized
- * acco- to the polarity of R-gr: non-polar a.a.
- * Biological: essential a.a.
- * Metabolic: mixed ketogenic and glucogenic.

(7) Tryptophan (Trp)



- * Chemical: neutral a.a. non ionized
- * acco- to the polarity of R-group: non-polar a.a.
- * Biological: essential a.a.
- * Metabolic: Glucogenic a.a.

(8) Methionine (Met)



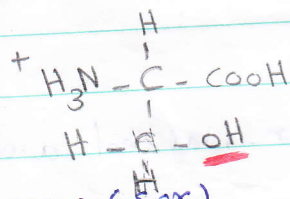
- * Chemical: neutral a.a. non ionized
- * acco- to the polarity of R-groups: non polar a.a.
- * Biological: ~~g~~ non-essential a.a.
- * Metabolic: glucogenic a.a.

(9) proline (Pro)

Name / structure /
letter code

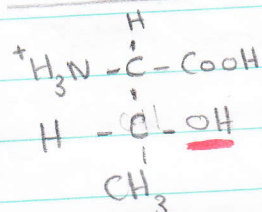
Classifications

Serine (Ser)



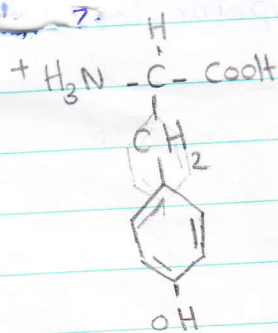
- * Chemical: neutral a.a
- * accor... to the polarity of R-gr: Polar-non ionized a.a
- * Biological: non essential a.a
- * Metabolic: Glucogenic a.a ✓

Threonine (thr)



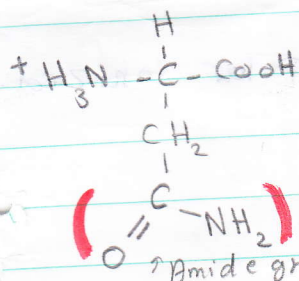
- * Chemical: neutral a.a
- * accor... to the polarity of R-gr: polar-non ionized a.a
- * Biological: Essential a.a
- * Metabolic: Glucogenic a.a

(12) Tyrosine (tyr)



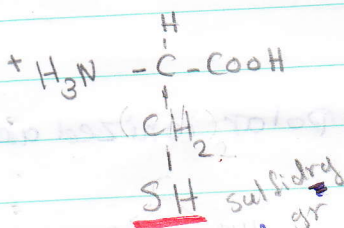
- * Chemical: neutral a.a
- * accor... to the polarity of R-gr: polar-non ionized a.a
- * Biological: non-essential a.a
- * Metabolic: mixed ketogenic and glucogenic a.a ✓

(13) Asparagine (asn)

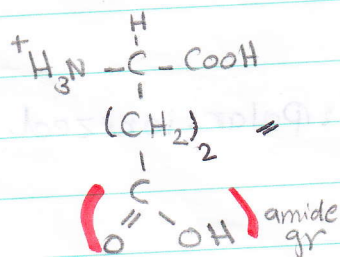


- * Chemical: neutral a.a
- * accor... to the polarity of R-gr: Polar-non ionized a.a
- * Biological: non-essential a.a
- * Metabolic: Glucogenic a.a ✓

(14) cysteine (cys)



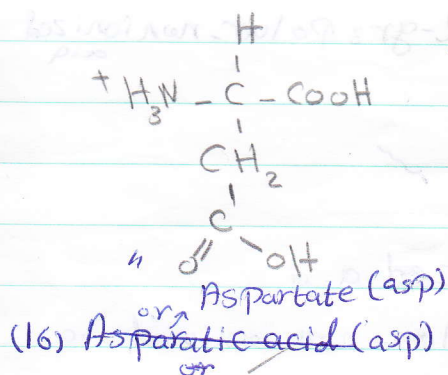
- * Chemical: neutral a.a
- * accor... to the polarity of R-gr: Polar-non ionized a.a
- * Biological: non-essential a.a
- * Metabolic: Glucogenic a.a ✓



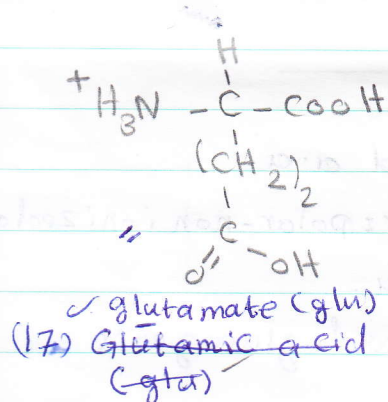
- * Chemical: neutral a.a
- * accor... to the polarity of R-gr: Polar-non ionized a.a
- * Biological: non-essential
- * Metabolic: glucogenic a.a ✓

a.a name/structure
and letter code

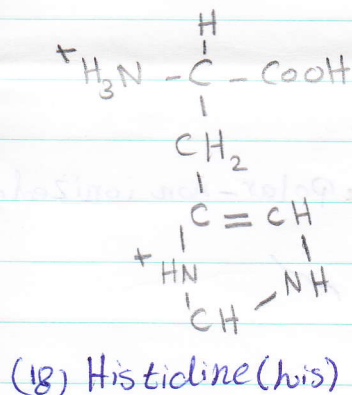
Classifications



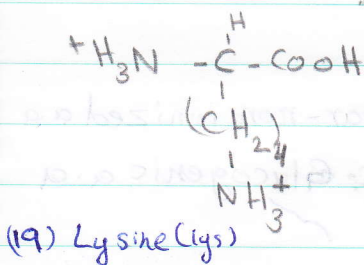
- * Chemical: acidic a.a.
- * accor. to the polarity of R-gr: polar-ionized a.a
- * Biological: non-essential.
- * Metabolic: Glucogenic a.a



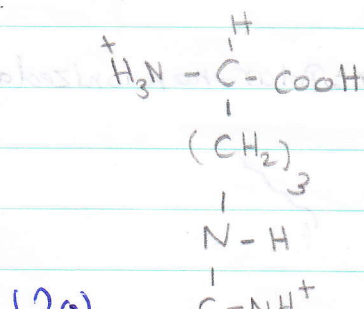
- * Chemical: Acidic a.a
- * accor. to the polarity of R-gr: polar-ionized a.a.
- * Biological: non-essential.
- * Metabolic: Glucogenic a.a



- * Chemical: Basic a.a .
- * accor. to the polarity of R-gr: polar ionized.
- * Biological: essential a.a .
- * Metabolic: Glucogenic a.a



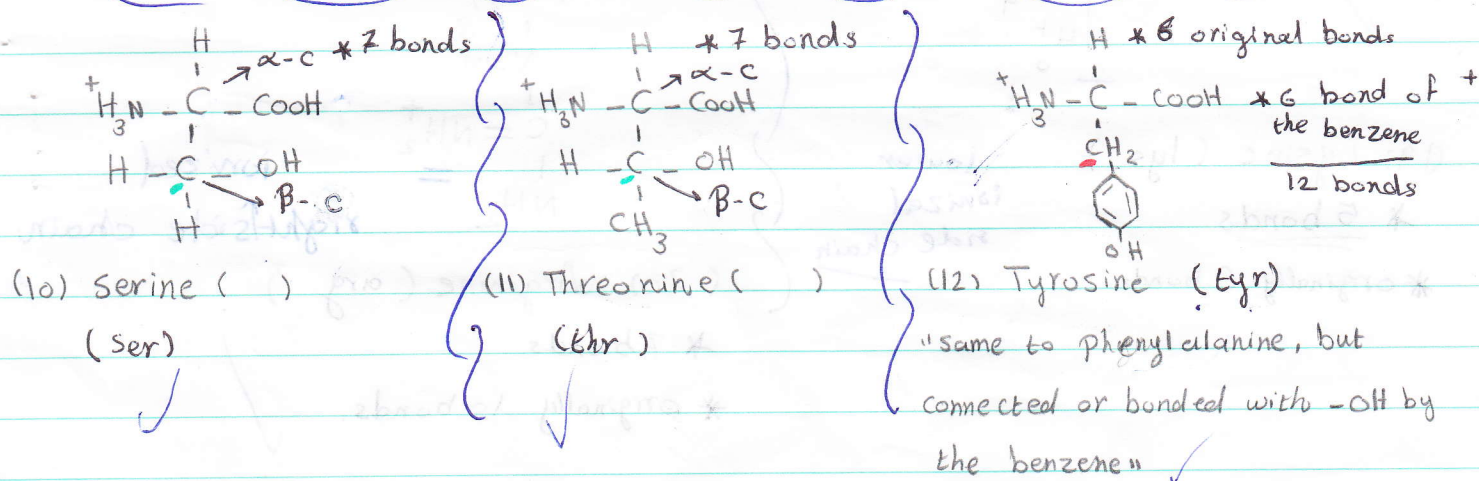
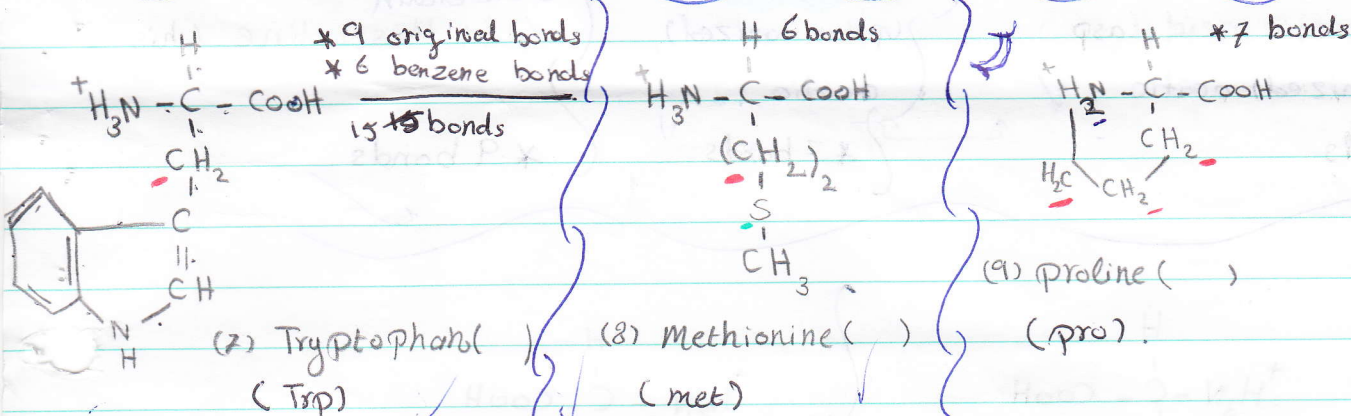
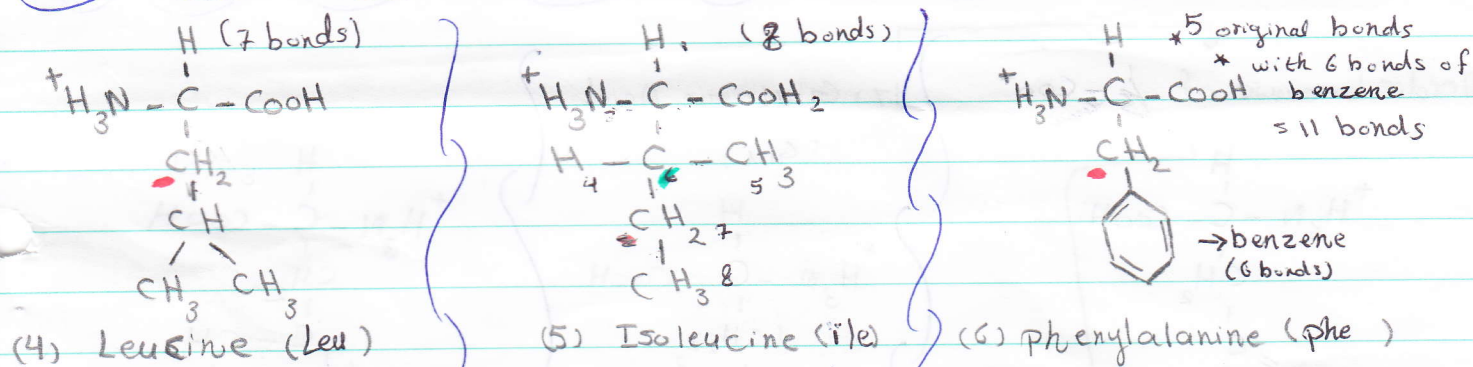
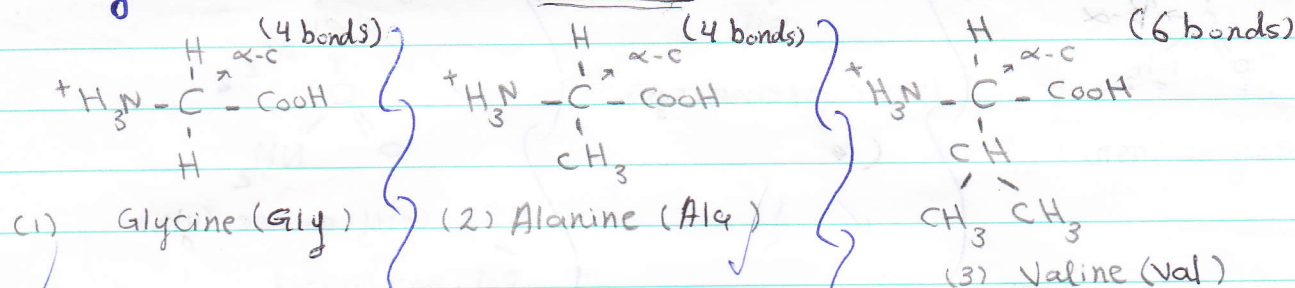
- * chemical: Basic a.a
- * accor. to the polarity of R-gr: polar ionized a.a
- * Biological: essential .
- * metabolic: Ketogenic a.a



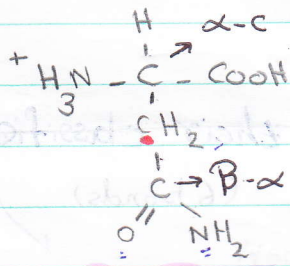
- * chemical: Basic a.a
- * accor. to the polarity of R-gr: polar-ionized.
- * Biological: essential a.a
- * metabolic: Glucogenic a.a

... "Amino Acids" ...

Firstly, mention the 20 a.a structure and their classifications.

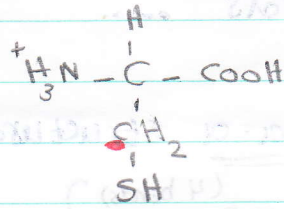


* 7 bonds



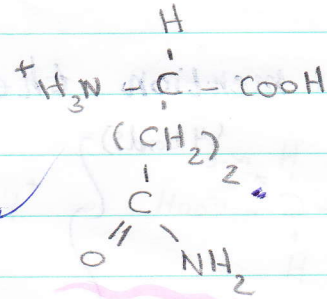
(13) Asparagine (asn)

* 5 bonds



(14) Cysteine (cys)

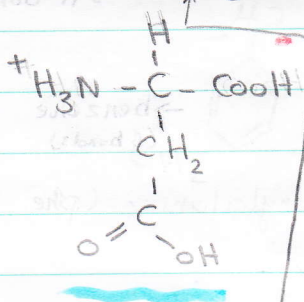
* 6 bonds



(15) Glutamine (gln)

Pol. non ionized

Acidic because of COO^-



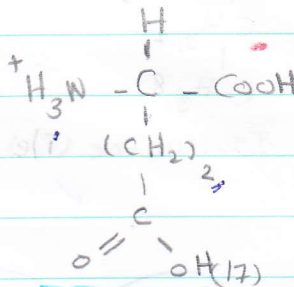
(16) Aspartic acid (asp)

(polar, ionized) acidic

* 7 bonds

(17) Glutamic Acid

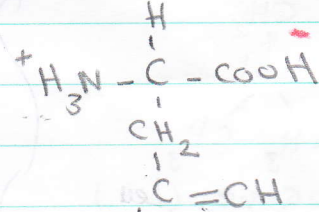
(Glu)



(polar, ionized)

acidic

* 7 bonds

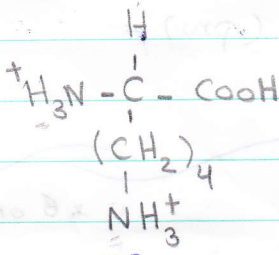


let ionized side chain

(18) Histidine (his)

* 9 bonds

①

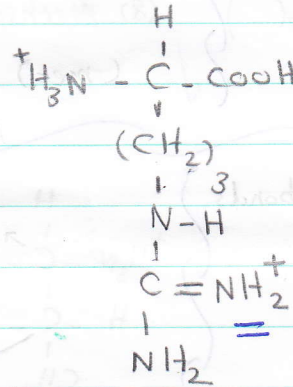


(19) Lysine (lys)

* 5 bonds

* originally 8 bonds

lower ionized side chain



ionized right side chain

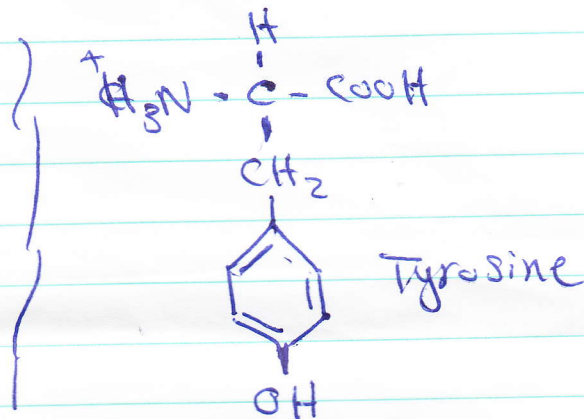
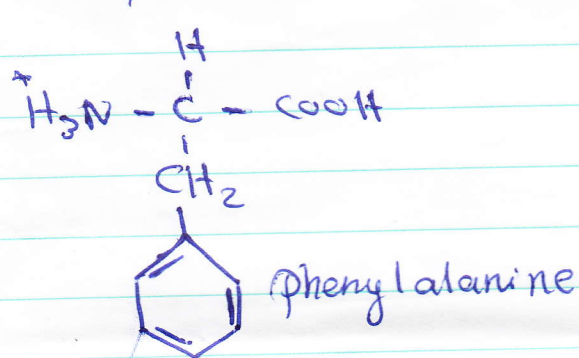
(20) Arginine (arg)

* 7 bonds

* originally 10 bonds

very fast - very important notes:

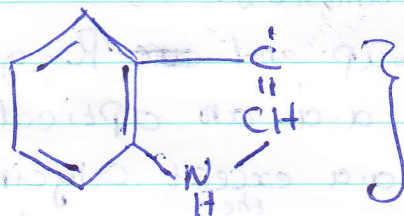
- 1 * Tyrosine has the same structure to phenylalanine, but with $-OH$ at the end (1st bond)



- 2 * Glutamine (Gln) has the same structure to the Asparagine (Asn)'s, but with 2 of $\text{CH}_2 \rightarrow (\text{CH}_2)_2$ Gln and CH_2 Asn

- * note: • all (both) acidic a.a are non-essential
- all basic a.a are essential

Q: The tryptophan a.a (trp) is non-polar, non-ionized, but it has a non polar neutral group called Indol group



The indol group

Q * How many a.a in the environment?
A: more than 300 a.a.

Q * How many a.a are constituents of mammalian proteins?
A: 20 a.a, They are only a.a that are coded by DNA.

Q * How many of these a.a are (a) essential.

A: 10 a.a are essential. (PVT TIM HALL) \Rightarrow 10 essential, 10 non-essential.

phenylalanine, Valine, Threonine, Tryptophan, Isoleucine, Methionine, Histidine, Arginine, Leucine, Lysine

the other (remaining) 10 a.a : non-essential

- Glycine, Alanine, aspartic, asparagine, glutamic, glutamine, proline, Serine, tyrosine and cysteine

* Every a.a of the 20 proteinic a.a has 4 groups are binded to the α -C atom, the (-COOH) carboxyl gr and (CH_3N) amino gr are combined in (peptide linkage), they are (-COOH and H_3N^+) groups are not available for chemical reactions EXCEPT for hydrogen bond formation.

* The amino acids have (H_3N^+) amino group, However proline is an exception which contains imino group (H_2N) .

* Every a.a has beside the -COOH group and H_3N^+ -group, H group and a distinctive group (called R-group) and all these group are connected to the $\alpha\text{-C}$ atom.

Q * When can we say that the a.a is optically active.
(b) the a.a is optically inactive
with examples. =)

A: When the H-group and ~~are~~ R-group are different we can call the a.a an optical active a.a

"example: all the a.a except Glycine"

• When the R^(-H) group is ^{the} same as the H-group then the a.a is optically inactive

example: Only Glycine $\text{H}_3\text{N}^+ - \underset{\text{H}}{\overset{\text{H}}{\text{C}}} - \text{COOH}$

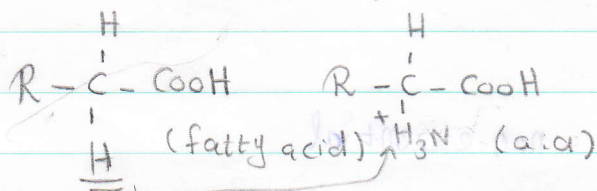
* What's the part of a.a that plays or ultimately dictates the role of a.a's role in protein?

A: The nature of side chains (R-group), whether it

^{non-}polar - non ionized * ^{non-}polar - non ionized * polar - ionized

* The original form of the a.a is the fatty acids

The H atom of the fatty acid is replaced by amino group.



* What does the polar side chain means?

• Polar side chain (-R group) means: the a.a has an ^(equal) even distribution of \bar{e}

• non polar side chain (-R group): the a.a has an uneven distribution of \bar{e} .